

# AERONAUTICAL CIRCULAR CIVIL AVIATION AUTHORITY – MACAO, CHINA

## SUBJECT:

### *Aircraft Maintenance Programme*

## EFFECTIVE DATE:

01 May 2023

## CANCELLATION:

Nil.

## GENERAL:

The President of Civil Aviation Authority, in exercise of his power under article 35 of the Statutes of Civil Aviation Authority approved by the Decree-Law 10/91/M and paragraph 89 of the Air Navigation Regulation of Macao (ANRM), established this Aeronautical Circular.

### 1. Introduction

- 1.1. Pursuant to paragraph 9 and OPSM.910 of the Nineteenth Schedule of ANRM, this AC prescribes the requirements of aircraft maintenance programme (AMP).
- 1.2. The related acceptable means of compliance (AMC) in accordance with paragraph 82A (1) of ANRM are provided in Appendix 1 and 2.

### 2. Definition

- 2.1. Unless the context otherwise specified, definitions in ANRM and other aeronautical circulars are applied to this AC.
- 2.2. **AMP management** means activities related to development, amendment and review of aircraft maintenance programme, and assessment of AMP effectiveness and/or reliability programme as applicable.

*Note: Organising performance of maintenance activities such as work pack preparation is not considered as AMP management.*

- 2.3. **Competency** is a combination of individual skills, practical and theoretical knowledge, attitudes, training, and experience.

### 3. Aircraft maintenance programme

- 3.1. Maintenance of each aircraft shall be organised in accordance with an AMP.
- 3.2. The AMP and any subsequent amendments thereto shall be approved by the AACM.
- 3.3. The design and application of AMP shall observe human factors principles.
- 3.4. When the continuing airworthiness of aircraft is managed by an operator with a maintenance system approved by the AACM in accordance with OPSM.885 of the Nineteenth Schedule of ANRM, the AMP and its amendments may be approved through an indirect approval procedure.

In that case, the indirect approval procedure shall be established by the operator concerned as part of the maintenance management exposition (MME) referred to in OPSM.905 of the Nineteenth Schedule of ANRM and shall be approved by the AACM referred to in OPSM.905 of the Nineteenth Schedule of ANRM.

- 3.5. The AMP shall demonstrate compliance with:
  - (a) the instructions issued by the AACM;
  - (b) the instructions for continuing airworthiness issued by the holders of the type certificate (TC), supplemental type certificate (STC), design change approval, repair design approval or any other approvals related to the airworthiness and environment certification of the aircraft, including any component for installation thereto;
- 3.6. By derogation to paragraph 3.5 above, the owner or the operator of the aircraft may deviate from the instruction referred to in paragraph 3.5 (b) and propose escalated intervals in the AMP, based on data obtained from sufficient reviews carried out in accordance with paragraph 3.9 below. Indirect approval is not permitted for the escalation of safety-related tasks. The owner or the operator of the aircraft may also propose additional instructions in the AMP.
- 3.7. The AMP shall contain details of all maintenance to be carried out, including frequency and any specific tasks linked to the type and specificity of operations.
- 3.8. For complex motor-powered aircraft, when the AMP is based on maintenance steering group logic or on condition monitoring, the AMP shall include a reliability programme.
- 3.9. The AMP shall be subject to periodic reviews and be amended accordingly when necessary. Those reviews shall ensure that the AMP continues to be up to date and valid in light of the operating experience and instructions from the AACM, while taking into account new or modified maintenance instructions issued by the holders of the type certificate, supplemental type certificate, design change approval, repair design approval or any other approvals related to the airworthiness and environment certification of the aircraft, including any component for installation thereto.

#### **4. Compliance monitoring**

The quality system referred to in OPSM.900 of the Nineteenth Schedule shall monitor compliance with, and the adequacy of, procedures of the operator to develop, amend and review the AMP. Compliance monitoring shall include a feedback system to the accountable manager to ensure corrective action as necessary.

#### **5. Record-keeping**

- 5.1. The operator shall record all details of work in relation to AMP management carried out.
- 5.2. The operator shall retain a copy of all records referred to paragraph 5.1 above until 3 years after the aircraft has been permanently transferred to another person or operator or withdrawn from service, whichever occurs first.
- 5.3. The operator shall ensure that records of qualification and experience of personnel involved in AMP management are retained.
- 5.4. Personnel records shall be kept as long as the person works for the organisation, and shall be retained until 3 years after the person has left the organisation.
- 5.5. The organisation shall establish a system of record-keeping that allows adequate storage and reliable traceability of all activities developed for AMP management.
- 5.6. The format of the records shall be specified in the MME.
- 5.7. Records shall be stored in a manner that ensures protection from damage, alteration and theft.

#### **6. Operator's maintenance management exposition**

The operator's MME, where applicable, any referenced associated manuals and procedures, shall contain the procedures specifying how the AMP is developed, amended and reviewed.

#### **7. Personnel requirements**

- 7.1. The operator shall ensure that there are sufficient appropriately qualified staff for AMP management.
- 7.2. The operator shall establish and control the competency of personnel involved in AMP management, in assessing its effectiveness and/or working on reliability programme in accordance with a procedure and to a standard agreed by the AACM. In addition to the necessary expertise related to the job function, competency must include an understanding of safety management and human factors principles appropriate to the person's function and responsibilities in the organisation.

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## Appendix 1 Acceptable means of compliance

### 1. AMC to paragraph 3 of AC/AW/038R00

#### Basic principles of AMP

- 1.1. The term 'maintenance programme' is intended to include scheduled maintenance tasks, the associated procedures and standard maintenance practises. The term 'maintenance schedule' is intended to embrace the scheduled maintenance tasks alone.
- 1.2. The aircraft should only be maintained to one approved maintenance programme at a given point in time. Where an owner or operator wishes to change from one approved programme to other, a transfer check or inspection may need to be performed in order to implement the change.
- 1.3. The maintenance programme details should be reviewed at least annually. As a minimum revisions of documents affecting the programme basis need to be considered by the owner or operator for inclusion in the maintenance programme during the annual review. Applicable mandatory requirements necessary for the continuing airworthiness of the aircraft should be incorporated into the aircraft maintenance programme as soon as possible.
- 1.4. The aircraft maintenance programme should contain a preface which will define the maintenance programme contents, the inspection standards to be applied, permitted variations to task frequencies and, where applicable, any procedure to manage the evolution of established check or inspection intervals.
- 1.5. Repetitive maintenance tasks derived from modifications and repairs should be incorporated into the approved maintenance programme.
- 1.6. Appendix 2 provide detailed information on the contents of an approved aircraft maintenance programme.
- 1.7. A maintenance programme may indicate that it applies to several aircraft registrations as long as the maintenance programme clearly identifies the effectivity of the tasks and procedures that are not applicable to all of the listed registrations.
- 1.8. Whereas the aircraft maintenance programme should be managed and presented by the operator to the AACM, the operator may subcontract certain AMP management functions to an maintenance organisation under contract, provided that the contract and arrangement, together with all amendments, is acceptable to the AACM.

## 2. AMC to paragraph 3.5 of AC/AW/038R00

### AMP basis and associated programmes

- 2.1. An aircraft maintenance programme should normally be based upon the maintenance review board (MRB) report where applicable, the maintenance planning document (MPD), the relevant chapters of the maintenance manual or any other maintenance data containing information on scheduling. Furthermore, an aircraft maintenance programme should also take into account any maintenance data containing information on scheduling for components.
- 2.2. Instructions issued by the AACM can encompass all types of instructions from a specific task for a particular aircraft to complete recommended maintenance schedules for certain aircraft types that can be used by the owner/operator directly. These instructions may be issued by the AACM in the following cases:
  - (a) in the absence of specific recommendations of the Type Certificate Holder.
  - (b) to provide alternate instructions to those described in the paragraph 2.1 of this Appendix above, with the objective of providing flexibility to the operator.
- 2.3. Where an aircraft type has been subjected to the MRB report process, an operator should normally develop the initial aircraft maintenance programme based upon the MRB report.
- 2.4. Where an aircraft is maintained in accordance with an aircraft maintenance programme based upon the MRB report process, any associated programme for the continuous surveillance of the reliability, or health monitoring of the aircraft should be considered as part of the aircraft maintenance programme.
- 2.5. Aircraft maintenance programmes for aircraft types subjected to the MRB report process should contain identification cross reference to the MRB report tasks such that it is always possible to relate such tasks to the current approved aircraft maintenance programme. This does not prevent the approved aircraft maintenance programme from being developed in the light of service experience to beyond the MRB report recommendations but will show the relationship to such recommendations.
- 2.6. Some approved aircraft maintenance programmes, not developed from the MRB process, utilise reliability programmes. Such reliability programmes should be considered as a part of the approved maintenance programme.
- 2.7. Alternate and/or additional instructions to those defined in paragraphs 3.5 of this AC, proposed by the owner or the operator, may include but are not limited to the following:
  - (a) Escalation of the interval for certain tasks based on reliability data or other supporting information. Appendix 2 recommends that the maintenance programme contains the

corresponding escalation procedures. The escalation of these tasks is directly approved by the AACM.

- (b) More restrictive intervals than those proposed by the TC holder as a result of the reliability data or because of a more stringent operational environment.
- (c) Additional tasks at the discretion of the operator.

### **3. AMC to paragraph 3.8 of AC/AW/038R00**

#### **Reliability programmes**

- 3.1. Reliability programmes should be developed for aircraft maintenance programmes based upon maintenance steering group (MSG) logic or those that include condition monitored components or that do not contain overhaul time periods for all significant system components.
- 3.2. Reliability programmes need not be developed for aircraft not considered complex motor-powered aircraft or that contain overhaul time periods for all significant aircraft system components.
- 3.3. The purpose of a reliability programme is to ensure that the aircraft maintenance programme tasks are effective and their periodicity is adequate.
- 3.4. The reliability programme may result in the escalation or deletion of a maintenance task, as well as the de-escalation or addition of a maintenance task
- 3.5. A reliability programme provides an appropriate means of monitoring the effectiveness of the maintenance programme.
- 3.6. Appendix 2 of this AC gives further guidance.

### **4. AMC to paragraph 5 of AC/AW/038R00**

#### **Record-keeping**

- 4.1. The record-keeping system should ensure that all records are accessible within a reasonable time whenever they are needed. These records should be organised in a manner that ensures their traceability and retrievability throughout the required retention period.
- 4.2. Records should be kept in paper form, or in electronic format, or a combination of the two. Records that are stored on microfilm or in optical disc formats are also acceptable. The records should remain legible throughout the required retention period. The retention period starts when the record is created or was last amended.
- 4.3. Paper systems should use robust materials which can withstand normal handling and filing. Computer record systems should have at least one backup system, which should be updated

within 24 hours of any new entry. Computer record systems should include safeguards to prevent unauthorised personnel from altering the data.

- 4.4. All computer hardware that is used to ensure the backup of data should be stored in a different location from the one that contains the working data, and in an environment that ensures that the data remains in good condition. When hardware or software changes take place, special care should be taken to ensure that all the necessary data continues to be accessible through at least the full period specified in the relevant provision. In the absence of any such indications, all records should be kept for a minimum period of 3 years.

## **5. AMC1 to paragraph 7.2 of AC/AW/038R00**

### **Competency assessment objectives**

- 5.1. The procedure referred to in paragraph 7.2 of this AC should require that personnel involved in AMP management are assessed for competency before unsupervised work commences and competency is controlled on a continuous basis.
- 5.2. Competency should be assessed by the evaluation of:
- (a) on-the-job performance and/or testing of knowledge by appropriately qualified personnel;
  - (b) records for basic, organisational, and/or product type and differences training; and
  - (c) experience records.
- 5.3. Validation of the above could include a confirmation check with the organisation(s) that issued such document(s). For that purpose, experience/training may be recorded in a document such as a log book.
- 5.4. As a result of this assessment, an individual's qualification should determine:
- (a) which level of ongoing supervision would be required and whether unsupervised work could be permitted;
  - (b) whether there is a need for additional training.
- 5.5. A record should be kept of each individual's qualifications and competency assessment (refer also to paragraph 5.3 of this AC). This should include copies of all documents that attest to their qualifications, such as an authorisation held, as applicable.
- 5.6. For a proper competency assessment of its personnel, the operator should consider the following:
- (a) In accordance with the job function, adequate initial and recurrent training should be provided and recorded to ensure continued competency so that it is maintained throughout the duration of the employment/contract.

- (b) All staff should be able to demonstrate knowledge of, and compliance with, the MME, any referenced associated manuals and procedures, as applicable to their duties.
- (c) All staff should be able to demonstrate an understanding of safety management principles including human factor, related to their job function and be trained as per Aeronautical Circular no. AC/GEN/005.
- (d) To assist in the assessment of competency and to establish the training needs analysis, job descriptions are recommended for each job function in the organisation. Job descriptions should contain sufficient criteria to enable the required competency assessment.
- (e) Criteria should allow the assessment to establish that, among other aspects (titles might be different in each organisation):
  - (1) Managers are able to properly manage processes, resources and priorities described in their assigned duties, accountabilities and responsibilities in accordance with the safety policy and objectives and in compliance with the applicable requirements and procedures.
  - (2) Maintenance programme engineers are able to interpret source data (norms, data issued by the holder of a design approval or by the AACM, etc.) and use them to develop the aircraft maintenance programme.
  - (3) Compliance monitoring staff are able to monitor compliance with all applicable regulation and to identify non-compliances in an effective and timely manner so that the operator may remain in compliance.
  - (4) All staff are familiar with the safety policy and the procedures and tools that can be used for internal safety reporting.
- (f) The competency assessment should be based upon the procedure specified in paragraph 6 of this Appendix.

5.7. In the case that the operator has subcontracted AMP management functions to an maintenance organisation under contract, the competency assessment of the personnel involved in AMP management of the contracted maintenance organisation shall be assessed in accordance with a procedure developed either by the operator, or the contracted maintenance organisation agreed by the operator, according to paragraph 6 of this Appendix.

## 6. AMC2 to paragraph 7.2 of AC/AW/038R00

### Competency assessment procedure

- 6.1. The operator, or the contracted maintenance organisation, should develop a procedure that describes the process for conducting competency assessment of personnel. The procedure should specify:
- (a) the persons who are responsible for this process;
  - (b) when the assessment should take place;
  - (c) how to give credit from previous assessments;
  - (d) how to validate qualification records;
  - (e) the means and methods to be used for the initial assessment;
  - (f) the means and methods to be used for the continuous control of competency, including to gather feedback on the performance of personnel;
  - (g) the aspects of competencies to be observed during the assessment in relation to each job function;
  - (h) the actions to be taken if the assessment is not satisfactory; and
  - (i) how to record assessment results.
- 6.2. Competency may be assessed by having the person work under the supervision of another qualified person for a sufficient time to arrive at a conclusion. Sufficient time could be as little as a few weeks if the person is fully exposed to relevant work.
- 6.3. All prospective personnel involved in AMP management should be assessed for their competency related to their intended duties.
- 6.4. In the case that the operator has subcontracted AMP management functions to a maintenance organisation under contract, the competency assessment may be carried out by the contracted maintenance organisation while the operator retains overall responsibility for compliance with the related requirements.

## 7. AMC3 to paragraph 7.2 of AC/AW/038R00

### Trainings

- 7.1. Personnel involved in the AMP management should receive both initial and recurrent safety training, appropriate for their responsibilities, either as a dedicated course or else integrated within other training. Such safety training should include:
  - (a) safety management system training in accordance with Aeronautical Circular no. AC/GEN/005; and
  - (b) human factor training, covering all topics of the training syllabus specified in GM1 145.30(e) of Aeronautical Circular no. AC/AW/011.
- 7.2. The operator should assess the need for particular training; for example, with regard to Electrical Wiring Interconnection System (EWIS), Continuing Structural Integrity Programme or Critical Design Configuration Control (CDCCL).
- 7.3. Personnel involved in AMP management, in assessing its effectiveness and/or working on reliability programme, should have knowledge of or be trained on statistical analysis and reliability method and the applicable methodology used in developing, as part of the instructions for continuing airworthiness (ICA), the manufacturer recommended maintenance programme (such as maintenance steering group logic).
- 7.4. Personnel involved in AMP management should have received Macao Airworthiness Course recognised by the AACM.
- 7.5. Adequate initial and recurrent training should be provided and recorded to ensure that staff remain competent.
- 7.6. Recurrent training should take into account certain information reported through the operator's internal safety reporting scheme under Aeronautical Circular no. AC/GEN/005.
- 7.7. Recurrent safety training should be of an appropriate duration in each 2-year period, in relation to the relevant compliance monitoring audit findings and other internal/external sources of information available to the organisation on safety and human factor issues.

## Appendix 2 Content of the maintenance programme

### 1. General requirements

- 1.1. The maintenance programme should contain the following basic information.
  - 1.1.1. The type/model and registration number of the aircraft, engines and, where applicable, auxiliary power units and propellers;
  - 1.1.2. The name and address of the owner or operator, and the organisation managing the aircraft maintenance programme as applicable;
  - 1.1.3. The reference, the date of issue and issue number of the approved maintenance programme;
  - 1.1.4. A statement signed by the owner or operator to the effect that the specified aircraft will be maintained to the programme and that the programme will be reviewed and updated as required;
  - 1.1.5. Contents/list of effective pages and their revision status of the document;
  - 1.1.6. Check periods, which reflect the anticipated utilisation of the aircraft. Such utilisation should be stated and include a tolerance of not more than 25%. Where utilisation cannot be anticipated, calendar time limits should also be included;
  - 1.1.7. Procedures for the escalation of established check periods, where applicable and acceptable to the AACM;
  - 1.1.8. Provision to record the date and reference of approved amendments incorporated in the maintenance programme;
  - 1.1.9. Details of pre-flight maintenance tasks that are accomplished by maintenance staff;
  - 1.1.10. The tasks and the periods (intervals/frequencies) at which each part of the aircraft, engines, APU's, propellers, components, accessories, equipment, instruments, electrical and radio apparatus, together with the associated systems and installations should be inspected. This should include the type and degree of inspection required;
  - 1.1.11. The periods at which components should be checked, cleaned, lubricated, replenished, adjusted and tested;
  - 1.1.12. If applicable details of ageing aircraft system requirements together with any specified sampling programmes;

- 1.1.13. If applicable, details of specific structural maintenance programmes including, but not limited to:
- (a) (supplemental) structural inspection programmes ((S)SIPs or (supplemental) structural inspection documents (S)SIDs) issued by the design approval holder;
  - (b) Corrosion prevention and control programmes (CPCPs) taking into account the baseline CPCP issued by the design approval holder.
- 1.1.14. If applicable, details of Critical Design Configuration Control Limitations together with appropriate procedures;
- 1.1.15. If applicable a statement of the limit of validity in terms of total flight cycles/calendar date/flight hours for the structural programme in paragraph 1.1.13 of this Appendix;
- 1.1.16. The periods at which overhauls and/or replacements by new or overhauled components should be made;
- 1.1.17. A cross-reference to other documents approved by AACM or the authority of the State of Design which contain the details of maintenance tasks related to mandatory life and inspection limitations, Certification Maintenance Requirements (CMRs) and ADs;
- Note: To prevent inadvertent variations to such tasks or intervals these items should not be included in the main portion of the maintenance programme document, or any planning control system, without specific identification of their mandatory status.*
- 1.1.18. Details of, or cross-reference to, any required reliability programme or statistical methods of continuous surveillance.
- 1.1.19. A statement that practices and procedures to satisfy the programme should be to the standards specified in the TC holder's Maintenance Instructions. In the case of approved practices and procedures that differ, the statement should refer to them.
- 1.1.20. Each maintenance task quoted should be defined in a definition section of the programme.

## 2. Programme basis

- 2.1. An owner or an operator aircraft maintenance programme should normally be based upon the MRB report, where applicable, and the TC holder's maintenance planning document or Chapter 5 of the maintenance manual, (i.e. the manufacturer's recommended maintenance programme).

The structure and format of these maintenance recommendations may be re-written by the owner or the operator to better suit the operation and control of the particular maintenance programme.

- 2.2. For a newly type-certificated aircraft where no previously approved maintenance programme exists, it will be necessary for the owner or the operator to comprehensively appraise the

manufacturer's recommendations (and the MRB report where applicable), together with other airworthiness information, in order to produce a realistic programme for approval.

- 2.3. For existing aircraft types it is permissible for the owner or operator to make comparisons with maintenance programmes previously approved. It should not be assumed that a programme approved for one owner or the operator would automatically be approved for another.

Evaluation should be made of the aircraft/fleet utilisation, landing rate, equipment fit and, in particular, the experience of the owner or the operator when assessing an existing programme.

Where the AACM is not satisfied that the proposed maintenance programme can be used as is, the AACM should request appropriate changes such as additional maintenance tasks or de-escalation of check frequencies as necessary.

- 2.4. Critical Design Configuration Control Limitations (CDCCL)

If CDCCL have been identified for the aircraft type by the TC/STC holder, maintenance instructions should be developed. CDCCL's are characterised by features in an aircraft installation or component that should be retained during modification, change, repair, or scheduled maintenance for the operational life of the aircraft or applicable component or part.

### **3. Amendments**

Amendments (revisions) to the approved maintenance programme should be made by the owner or the operator, to reflect changes in the TC holder's recommendations, modifications, service experience, or as required by the AACM.

### **4. Permitted variations to maintenance periods**

The owner or the operator may only vary the periods prescribed by the programme with the approval of the AACM or through a procedure developed in the maintenance programme and approved by the AACM.

### **5. Periodic review of maintenance programme contents**

- 5.1. The owner or the operator approved maintenance programmes should be subject to periodic review to ensure that they reflect current TC holder's recommendations, revisions to the MRB report if applicable, mandatory requirements and the maintenance needs of the aircraft.
- 5.2. The owner or the operator should review the detailed requirements at least annually for continued validity in the light of operating experience.

## 6. Reliability Programmes

### 6.1. Applicability

6.1.1. A reliability programme should be developed in the following cases:

- (a) the aircraft maintenance programme is based upon MSG-3 logic;
- (b) the aircraft maintenance programme includes condition monitored components;
- (c) the aircraft maintenance programme does not contain overhaul time periods for all significant system components;
- (d) when specified by the manufacturer's maintenance planning document or MRB.

6.1.2. A reliability programme need not be developed in the following cases:

- (a) the maintenance programme is based upon the MSG-1 or 2 logic but only contains hard time or on condition items;
- (b) the aircraft is not a complex motor-powered aircraft according to MAR-145;
- (c) the aircraft maintenance programme provides overhaul time periods for all significant system components;

*Note: for the purpose of this paragraph, a significant system is a system the failure of which could hazard the aircraft safety.*

6.1.3. Notwithstanding paragraphs 6.1.1 and 6.1.2 above, an operator may however, develop its own reliability monitoring programme when it may be deemed beneficial from a maintenance planning point of view.

### 6.2. Applicability for operator of small fleets of aircraft

6.2.1. For the purpose of this paragraph, a small fleet of aircraft is a fleet of less than 6 aircraft of the same type.

6.2.2. The requirement for a reliability programme is irrespective of the operator's fleet size.

6.2.3. Complex reliability programmes could be inappropriate for a small fleet. It is recommended that such operators tailor their reliability programmes to suit the size and complexity of operation.

6.2.4. One difficulty with a small fleet of aircraft consists in the amount of available data which can be processed: when this amount is too low, the calculation of alert level is very coarse. Therefore "alert levels" should be used carefully.

6.2.5. An operator of a small fleet of aircraft, when establishing a reliability programme, should consider the following:

- (a) The programme should focus on areas where a sufficient amount of data is likely to be processed.
- (b) When the amount of available data is very limited, the operator's engineering judgement is then a vital element. In the following examples, careful engineering analysis should be exercised before taking decisions:
  - (1) A '0' rate in the statistical calculation may possibly simply reveal that enough statistical data is missing, rather than there is no potential problem.
  - (2) When alert levels are used, a single event may have the figures reach the alert level. Engineering judgement is necessary so as to discriminate an artefact from an actual need for a corrective action.

In making his engineering judgement, an operator is encouraged to establish contact and make comparisons with other operators of the same aircraft, where possible and relevant. Making comparison with data provided by the manufacturer may also be possible.

6.2.6. In order to obtain accurate reliability data, it should be recommended to pool data and analysis with one or more other operator(s). Paragraph 6.6 of this Appendix specifies under which conditions it is acceptable that operators share reliability data.

6.2.7. Notwithstanding the above there are cases where the operator will be unable to pool data with other operator, e.g. at the introduction to service of a new type. In that case the AACM should impose additional restrictions on the MRB/MPD tasks intervals (e.g. no variations or only minor evolution are possible, and with the AACM approval).

### 6.3. Engineering judgement

6.3.1. Engineering judgement is itself inherent to reliability programmes as no interpretation of data is possible without judgement. In approving the operator maintenance and reliability programmes, the AACM is expected to ensure that the organisation which runs the programme (it may be operator, or an MAR-145 organisation under contract) hires sufficiently qualified personnel with appropriate engineering experience and understanding of reliability concept.

6.3.2. It follows that failure to provide appropriately qualified personnel for the reliability programme may lead the AACM to reject the approval of the reliability programme and therefore the aircraft maintenance programme.

#### 6.4. Contracted maintenance

6.4.1. Whereas paragraph 3 of this AC specifies that, the aircraft maintenance programme, which includes the associated reliability programme, should be managed and presented by the operator to the AACM, the operator may subcontract certain functions to the maintenance organisation under contract, provided this organisation proves to have the appropriate expertise.

6.4.2. These functions are:

- (a) Developing the aircraft maintenance and reliability programmes;
- (b) Performing the collection and analysis of the reliability data;
- (c) Providing reliability reports; and
- (d) Proposing corrective actions to the operator.

6.4.3. Notwithstanding the above decision to implement a corrective action (or the decision to request from the AACM the approval to implement a corrective action) remains the operator's prerogative and responsibility. In relation to paragraph 6.4.2 (d) above, a decision not to implement a corrective action should be justified and documented.

6.4.4. The arrangement between the operator and the maintenance organisation should be specified in the maintenance contract and the relevant MME, and maintenance organisation procedures.

#### 6.5. Reliability programme

In preparing the programme details, account should be taken of this paragraph. All associated procedures should be clearly defined.

##### 6.5.1. Objectives

6.5.1.1 A statement should be included summarising as precisely as possible the prime objectives of the programme. To the minimum it should include the following:

- (a) to recognise the need for corrective action;
- (b) to establish what corrective action is needed; and
- (c) to determine the effectiveness of that action.

6.5.1.2 The extent of the objectives should be directly related to the scope of the programme. Its scope could vary from a component defect monitoring system for a small operator, to an integrated maintenance management programme for a big operator. The manufacturer's

maintenance planning documents may give guidance on the objectives and should be consulted in every case.

6.5.1.3 In case of a MSG-3 based maintenance programme, the reliability programme should provide a monitor that all MSG-3 related tasks from the maintenance programme are effective and their periodicity is adequate.

#### 6.5.2. Identification of items

The items controlled by the programme should be stated, e.g. by ATA Chapters. Where some items (e.g. aircraft structure, engines, APU) are controlled by separate programmes, the associated procedures (e.g. individual sampling or life development programmes, constructor's structure sampling programmes) should be cross referenced in the programme.

#### 6.5.3. Terms and definitions

The significant terms and definitions applicable to the Programme should be clearly identified. Reference should be made to the terms which are already defined in MSG-3, MAR-145 and ANRM.

#### 6.5.4. Information sources and collection

6.5.4.1 Sources of information should be listed and procedures for the transmission of information from the sources, together with the procedure for collecting and receiving it, should be set out in detail in the MME or maintenance organisation exposition (MOE) as appropriate.

6.5.4.2 The type of information to be collected should be related to the objectives of the programme and should be such that it enables both an overall broad based assessment of the information to be made and also allow for assessments to be made as to whether any reaction, both to trends and to individual events, is necessary. The following are examples of the normal prime sources:

- (a) Pilots reports
- (b) Technical logs
- (c) Aircraft maintenance access terminal / on-board maintenance system readouts
- (d) Maintenance worksheets
- (e) Workshop reports
- (f) Reports on functional checks
- (g) Reports on special inspections

- (h) Stores issues/reports
- (i) Air safety reports
- (j) Reports on technical delays and incidents
- (k) Other sources: ETOPS, RVSM, CAT II/III

6.5.4.3 In addition to the normal prime sources of information, due account should be taken of continuing airworthiness and safety information promulgated by the holders of the type certificate, supplemental type certificate, design change approval, repair design approval or any other approvals related to the airworthiness and environment certification of the aircraft, including any component for installation thereto.

#### 6.5.5. Display of information

Collected information may be displayed graphically or in a tabular format or a combination of both. The rules governing any separation or discarding of information prior to incorporation into these formats should be stated. The format should be such that the identification of trends, specific highlights and related events would be readily apparent.

6.5.5.1 The above display of information should include provisions for 'nil returns' to aid the examination of the total information.

6.5.5.2 Where 'standards' or 'alert levels' are included in the programme, the display of information should be oriented accordingly.

#### 6.5.6. Examination, analysis and interpretation of the information.

The method employed for examining, analysing and interpreting the programme information should be explained.

##### 6.5.6.1 Examination

Methods of examination of information may be varied according to the content and quantity of information of individual programmes. These can range from examination of the initial indication of performance variations to formalised detailed procedures at specific periods, and the methods should be fully described in the programme documentation.

##### 6.5.6.2 Analysis and Interpretation

The procedures for analysis and interpretation of information should be such as to enable the performance of the items controlled by the programme to be measured; they should also facilitate recognition, diagnosis and recording of significant problems. The whole process

should be such as to enable a critical assessment to be made of the effectiveness of the programme as a total activity. Such a process may involve:

- (a) Comparisons of operational reliability with established or allocated standards (in the initial period these could be obtained from in-service experience of similar equipment of aircraft types);
- (b) Analysis and interpretation of trends;
- (c) The evaluation of repetitive defects;
- (d) Confidence testing of expected and achieved results;
- (e) Studies of life-bands and survival characteristics;
- (f) Reliability predictions;
- (g) Other methods of assessment.

6.5.6.3 The range and depth of engineering analysis and interpretation should be related to the particular programme and to the facilities available. The following, at least, should be taken into account:

- (a) Flight defects and reductions in operational reliability;
- (b) Defects occurring on-line and at main base;
- (c) Deterioration observed during routine maintenance;
- (d) Workshop and overhaul facility findings;
- (e) Modification evaluations;
- (f) Sampling programmes;
- (g) The adequacy of maintenance equipment and publications;
- (h) The effectiveness of maintenance procedures;
- (i) Staff training;
- (j) Service bulletins, technical instructions, etc.

6.5.6.4 Where the operator relies upon contracted maintenance and/or overhaul facilities as an information input to the programme, the arrangements for availability and continuity of such information should be established and details should be included.

### 6.5.7. Corrective Actions

6.5.7.1 The procedures and time scales both for implementing corrective actions and for monitoring the effects of corrective actions should be fully described. Corrective actions shall correct any reduction in reliability revealed by the programme and could take the form of:

- (a) Changes to maintenance, operational procedures or techniques;
- (b) Maintenance changes involving inspection frequency and content, function checks, overhaul requirements and time limits, which will require amendment of the scheduled maintenance periods or tasks in the approved maintenance programme. This may include escalation or de-escalation of tasks, addition, modification or deletion of tasks;
- (c) Amendments to approved manuals (e.g. maintenance manual, crew manual);
- (d) Initiation of modifications;
- (e) Special inspections of fleet campaigns;
- (f) Spares provisioning;
- (g) Staff training;
- (h) Manpower and equipment planning.

*Note: Some of the above corrective actions may need the AACM's approval before implementation.*

6.5.7.2 The procedures for effecting changes to the maintenance programme should be described, and the associated documentation should include a planned completion date for each corrective action, where applicable.

### 6.5.8. Organisational responsibilities

The organisational structure and the department responsible for the administration of the programme should be stated. The chains of responsibility for individuals and departments (Engineering, Production, Quality, Operations etc.) in respect of the programme, together with the information and functions of any programme control committees (reliability group), should be defined. Participation of the AACM should be stated. This information should be contained in the MME as appropriate.

### 6.5.9. Presentation of information to the AACM

The following information should be submitted to the AACM for approval as part of the reliability programme:

- (a) The format and content of routine reports;

- (b) The time scales for the production of reliability reports together with their distribution;

*Note: AACM should be included in the distribution list of reliability reports.*

- (c) The format and content of reports supporting request for increases in periods between maintenance (escalation) and for amendments to the approved maintenance programme. These reports should contain sufficient detailed information to enable the AACM to make its own evaluation where necessary.

#### 6.5.10. Evaluation and review

Each programme should describe the procedures and individual responsibilities in respect of continuous monitoring of the effectiveness of the programme as a whole. The time periods and the procedures for both routine and non-routine reviews of maintenance control should be detailed (progressive, monthly, quarterly, or annual reviews, procedures following reliability 'standards' or 'alert levels' being exceeded, etc.).

- 6.5.10.1 Each programme should contain procedures for monitoring and, as necessary, revising the reliability 'standards' or 'alert levels'. The organisational responsibilities for monitoring and revising the 'standards' should be specified together with associated time scales.

- 6.5.10.2 Although not exclusive, the following list gives guidance on the criteria to be taken into account during the review.

- (a) Utilisation (high/low/seasonal)
- (b) Fleet commonality
- (c) Alert level adjustment criteria
- (d) Adequacy of data
- (e) Reliability procedure audit
- (f) Staff training
- (g) Operational and maintenance procedures

#### 6.5.11. Approval of maintenance programme amendment

The AACM may authorise the operator to implement in the maintenance programme changes arising from the reliability programme results prior to their formal approval by the authority when satisfied that;

- (a) the reliability programme monitors the content of the maintenance programme in a comprehensive manner, and

- (b) the procedures associated with the functioning of the ‘reliability group’ provide the assurance that appropriate control is exercised by the operator over the internal validation of such changes.

## 6.6. Pooling arrangements

6.6.1. In some cases, in order that sufficient data may be analysed it may be desirable to ‘pool’ data: i.e. collate data from a number of operators of the same type of aircraft. For the analysis to be valid, the aircraft concerned, mode of operation, and maintenance procedures applied should be substantially the same: variations in utilisation between two operators may, more than anything, fundamentally corrupt the analysis. Although not exhaustive, the following list gives guidance on the primary factors which need to be taken into account.

- (a) Certification factors, such as: aircraft TCDS compliance (variant)/modification status, including SB compliance.
- (b) Operational factors, such as: operational environment/utilisation, e.g. low/high/seasonal, etc./respective fleet size operating rules applicable (e.g. ETOPS/RVSM/All Weather etc.)/operating procedures/MEL and MEL utilisation.
- (c) Maintenance factors, such as: aircraft age maintenance procedures; maintenance standards applicable; lubrication procedures and programme; MPD revision or escalation applied or maintenance programme applicable.

6.6.2. Although it may not be necessary for all of the foregoing to be completely common, it is necessary for a substantial amount of commonality to prevail. Decision should be taken by the AACM on a case by case basis.

6.6.3. In case of a short term lease agreement (less than 6 month) more flexibility against the para 6.6.1 criteria may be granted by the AACM, so as to allow the owner/operator to operate the aircraft under the same programme during the lease agreement effectivity.

6.6.4. Changes by any one of the operator to the above, requires assessment in order that the pooling benefits can be maintained. Where an operator wishes to pool data in this way, the approval of the AACM should be sought prior to any formal agreement being signed between operators.

6.6.5. Whereas this paragraph 6.6 is intended to address the pooling of data directly between operators, it is acceptable that the operator participates in a reliability programme managed by the aircraft manufacturer, when the AACM is satisfied that the manufacturer manages a reliability programme which complies with the intent of this paragraph.